DETAILED ACTION

Claim Objections

1. Claims 10 and 11 objected to because of the following informalities: Use of the term “modelled and modelling”. Applicant likely meant “modeled and modeling.” Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 12 and 15 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

As to claim 12, the term "as low as possible" in claim 12 is a relative term which renders the claim indefinite. The term "as low as possible" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

As to claim 15, the term "low" in claim 15 is a relative term which renders the claim indefinite. The term "low" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. Claims 9-12 and 14-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Manley (cited in IDS) in view of Harra (US 5,417,833).

As to claim 9, Manley discloses a method for enhancing the erosion uniformity on the sputtering surface of a magnetron cathodic target wherein:

- At least one ferromagnetic piece is added by juxtaposition to said target according to predetermined characteristics of location, shape, and size (figure 7, col 13 lines 30-35: showing addition of soft Fe magnetic shunt 18 adjacent to target 14; col 12 lines 57-65: thickness, width and position of shunt determined); and
- To bring about, at the entire sputtering surface, an increase in the parallelism of the magnetic induction lines generated by the magnetron

(col 12 lines 64-66: positioning shunt 18 to obtain parallel magnetic flux along target surface).

Manley discloses a method of enhancing erosion efficiency with target materials and discloses examples that use ferromagnetic targets (column 7, lines 56-60). However, one reading Manley as whole would have readily appreciated that the use of a ferromagnetic target is not critical to the invention. The critical feature is the magnetic shunt, which saturates the target with the magnetic field and shunts excess magnetic flux liberated by the erosion of the target (col 6 lines 29-35 and 50-55). One of ordinary skill in the art would have readily appreciated that this manipulation of the magnetic induction lines would be achieved regardless of the material of the target. However, Manley does not explicitly disclose the use of this method in combination with a target that is non-ferromagnetic.

Harra discloses a method of magnetron sputtering where the magnetic induction lines are manipulated to obtain a desired erosion profile from a non-ferromagnetic sputtering target, such as aluminum (col 8 lines 39-45; column 16, lines 60-65). Harra's manipulation of the magnetic induction lines allows for better utilization of the target (col 14 lines 59-62).

Selection of a particular material for the target of Manley would have been within purview of one having ordinary skill in the art depending on the desired product. However, it would have been obvious to one of ordinary skill in the art at the time of the invention to use a non-ferromagnetic target, as disclosed by Harra, in the method of enhancing erosion uniformity of Manley, because only the expected results of

manipulating the magnetic induction lines to obtain good utilization of the target would have been achieved (Harra at col 10 lines 7-10).

As to claim 10, Manley discloses comparing the measured values and the modeled values of the total magnetic induction, B_{total}, generated by the magnetron on the target sputtering surface and of the vertical component, B_z, of said magnetic induction (col 14 lines 25-40: after positioning shunt according to model, field parallelism and strength is computed and shunt is repositioned to obtain best results), searching a modelized induction the characteristics of location, shape, and size of at least one ferromagnetic piece able to bring about, at the sputtering surface, the desired increase of the parallelism of the magnetic induction lines (col 12 lines 58-66: use of a model to determine shunt characteristics to obtain parallel magnetic flux lines), and optimizing, by means of the B_z/B_{total} parameter, the selected location, shape and size (col 12 lines 58-66; Increasing the parallelism of the magnetic flux will inherently decrease B_z).

As to claim 11, Manley discloses measuring the values of the total magnetic induction generated by the magnetron at the target sputtering surface and of the vertical component of this magnetic induction (col 14 lines 25-40 and 45-55: measuring field strength and shape [shape of field will inherently include vertical component]), calculating and modeling, by means of software assisted computer technique, the total magnetic induction generated by the magnetron at the target sputtering surface and of the vertical component of this magnetic induction (col 12 lines 58-66: use of a model to determine shunt characteristics to obtain parallel magnetic flux lines; col 8 lines 27-32: use of computer for modeling), validating the modeling by comparing the calculated

values of the total magnetic induction of the one hand and of its vertical component on the other hand with the corresponding measured values (col 14 lines 30-40: after model and calculated values determined, adjusting shunt position to produce optimal results), searching in this modeled induction the characteristics of location, shape, and size of at least one ferromagnetic piece which, once in contact with the sputtering target, is able to bring about, at the target sputtering surface, the desired increase of the parallelism of the magnetic induction lines (col 12 lines 58-66: use of a model to determine shunt characteristics [length, width, position] to obtain parallel magnetic flux lines), and optimizing, by means of the B_z/B_{total} parameter, the selected location, shape and size (col 12 lines 58-66: use of a model to determine shunt characteristics [length, width, position] to obtain parallel magnetic flux lines; parallel magnetic lines inherently require as a B_z value; col 14 lines 24-40: adjusting magnetic shunt position to obtain desired total magnetic field strength).

As to claim 12, Manley discloses the characteristics of location, shape, and size are optimized via the selection of the magnetic induction area where the value of B_z/B_{total} parameter is as low as possible, the magnetic induction remaining sufficient in order to bring about an efficient confinement of the electrons at the target sputtering surface (col 12 lines 58-66: use of a model to determine shunt characteristics [length, width, position] to obtain parallel magnetic flux lines; parallel magnetic lines inherently require as a B_z value; col 14 lines 24-40: adjusting magnetic shunt position to obtain desired total magnetic field strength).

As to claim 14, Manley discloses the ferromagnetic piece is added by juxtaposition on one wall of the sputtering target (figure 7: showing magnetic shunt 18 juxtaposed to bottom wall of target 14).

As to claim 15, Harra discloses the target is made of a low melting point material (Col 16 lines 60-65: example of method involving sputtering with an aluminum target [Al melts at 933 K as opposed to Ti at 1935 K or W at 3695 K]) and Manley discloses a ferromagnetic piece juxtaposed to a sputtering target's lower wall face (figures 7: showing addition of magnetic shunt 18 adjacent to target 14).

7. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Manley in view of Harra as applied to claim 9 above, and further in view of Minami (cited in IDS).

As to claim 13, Manley is silent as the ferromagnetic piece being added by partial or complete insertion in the sputtering target.

Minami discloses inserting a ferromagnetic piece into a sputtering target (English abstract). The insertion of the ferromagnetic piece is disclosed as controlling the plasma to reduce damage to the substrate and to deposit a thin film having high quality and performance (English abstract).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to insert the ferromagnetic piece into the target, as disclosed by Minami, in the method of enhancing erosion uniformity of Manley, in order to reduce damage to the substrate and to deposit a thin film having high quality and performance.

Correspondence Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason M. Berman whose telephone number is (571)270-5265. The examiner can normally be reached on M-R 8am-5pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jessica Ward can be reached on (571)272-1223. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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